

SOUTH FLORIDA WATER MANAGEMENT DISTRICT



South Florida Water Management District

WRAC MEETING AGENDA ADDENDUM

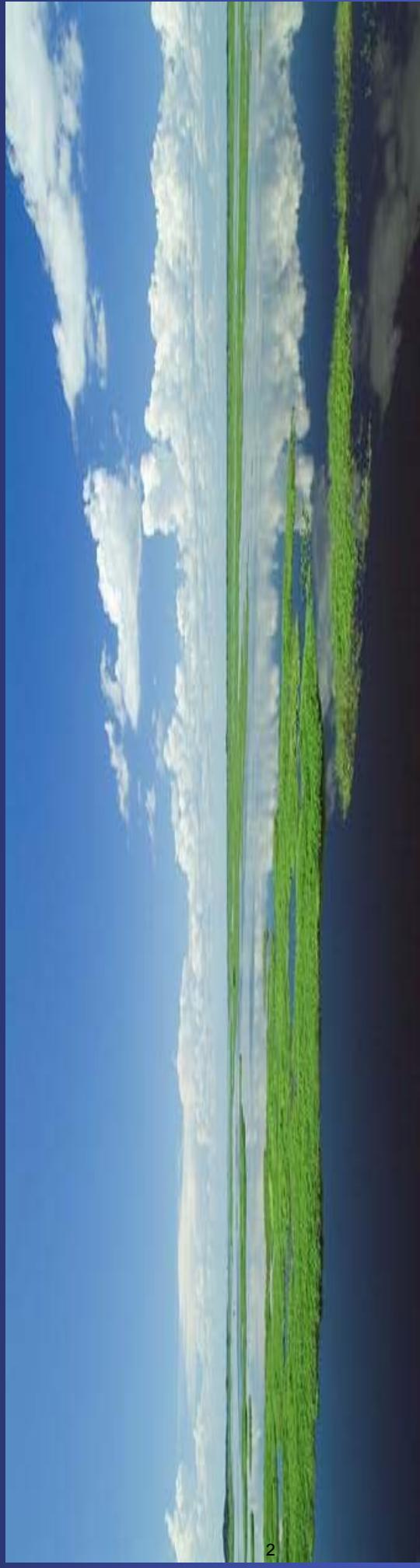
March 5, 2009

Supporting documents for the following item have been added:

Item #5

See supporting document: [Chip Kiss WR March WRAC.pdf](#)

Kissimmee Basin Water Reservation Rule Development Update



*Chip Merriam, Deputy Executive Director, Water Resources
Water Resource Advisory Commission
March 5, 2009*



sfwmd.gov

Objectives of Today's Presentation

- Describe assumptions and results of the technical evaluations conducted to date
 - River
 - Kissimmee Chain of Lakes
- Provide preliminary results of the waters needed for protection of fish and wildlife
 - Identify additional analyses to be conducted
 - Identify emerging policy challenges

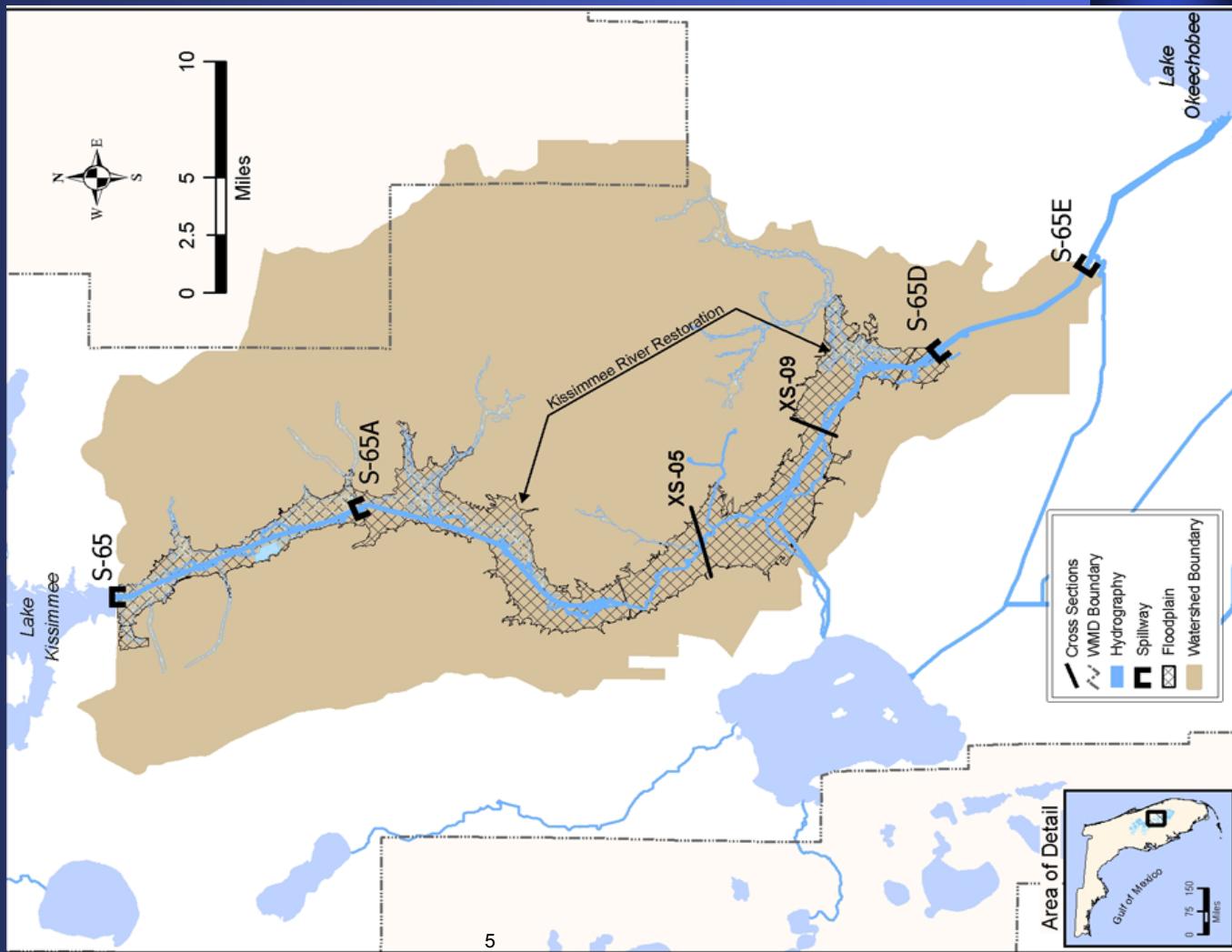


Process for Defining Water to be Reserved

- Step #1: Identify the “Reservation Waterbodies”
- Step #2: Identify fish and wildlife species and habitat to be protected
- Step #3: Identify the ‘with project base’ hydrology (total water available)
- Step #4: Establish linkages between hydrology and biology (performance measures)
- Step #5: Identify water necessary for protection of fish and wildlife (water reservation)

Step 1: Reservation Waterbodies: Kissimmee River and Floodplain

- Restored Kissimmee River and floodplain (S-65 to S-65E)
- 103 miles of River and floodplain
- 27,000 acres wetland habitat



Key Assumptions: Restored River



- Fish and wildlife to be protected based on restored river and floodplain
- Hydrology of pre-channelized condition protective of fish and wildlife
- Performance measures for reservation established through River Restoration process

Step 2: Fish & Wildlife of the Kissimmee River and Floodplain

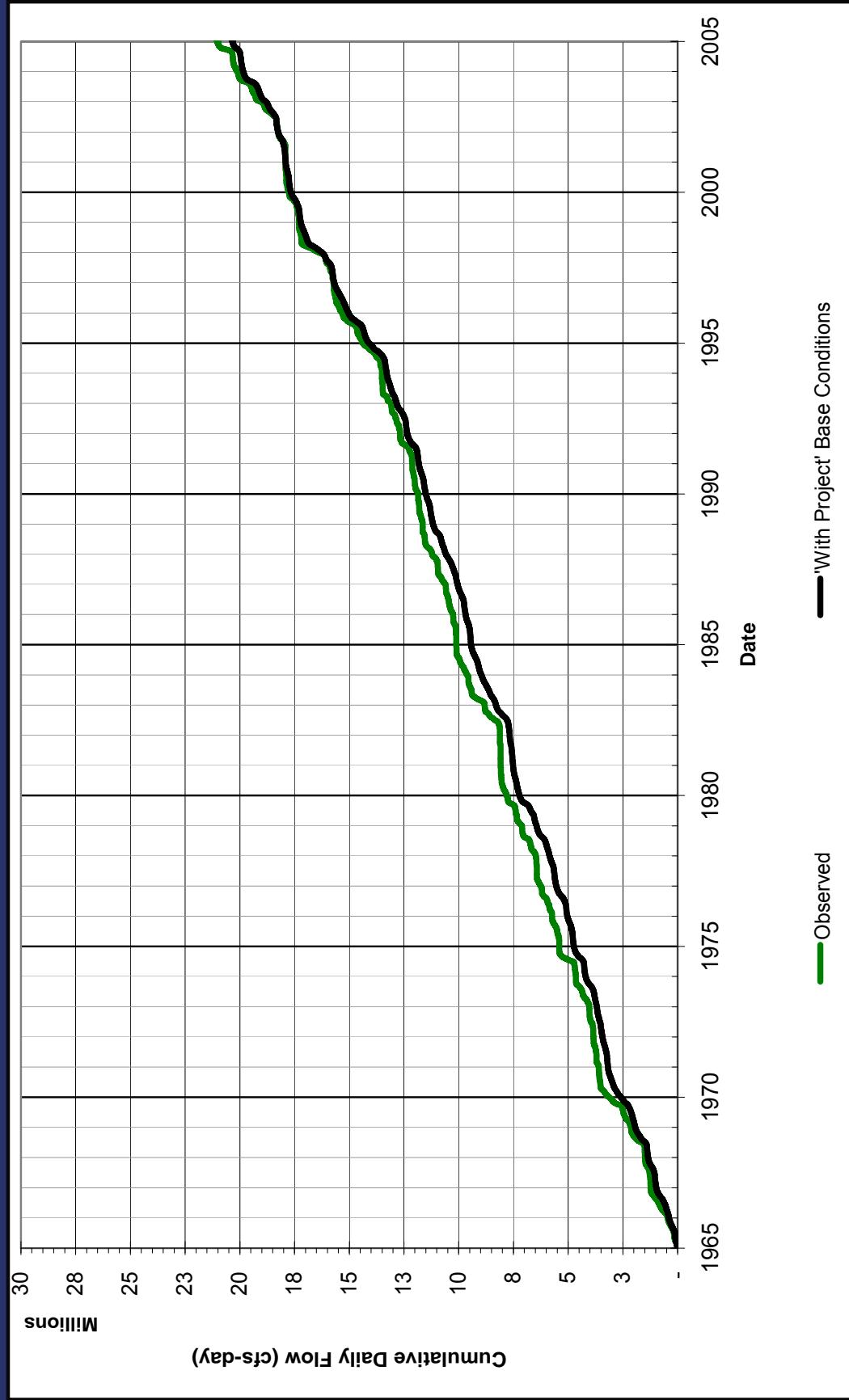
Fish Community

- 52 species of fish use the river channel or floodplain (includes 6 exotic species)
- Water birds
 - 68 species of wetland dependent birds
 - 14 species of wading birds including Federally endangered wood stork
 - 16 species of ducks
- Amphibians and Reptiles – 24 species
- Mammals – 4 species wetland river/dependent

Step 3: Identify the 'with project base' hydrology

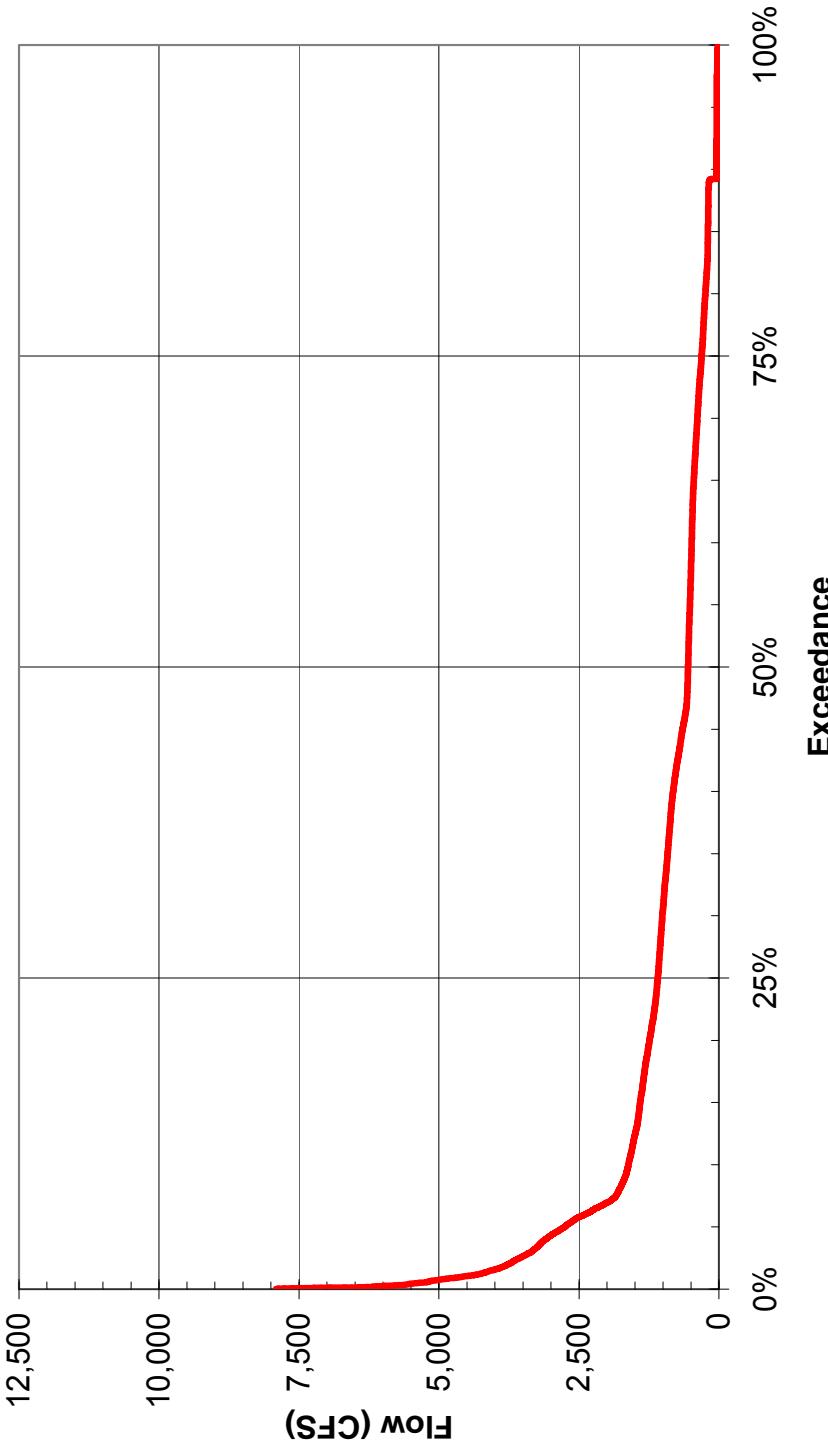
- The modeling tools have undergone a series of calibration and verification
- Modeling tools have been peer reviewed
- Peer review comments have been incorporated and the integrated model undergone a rigorous re-calibration process
- The modeling tool has been verified against the most sensitive parameter: Runoff

Step 3: 'With project base'; Cumulative Basin Discharge



Step 3: Identify the 'with project base' hydrology

Kissimmee Basin Water Reservations
With Project Base Conditions

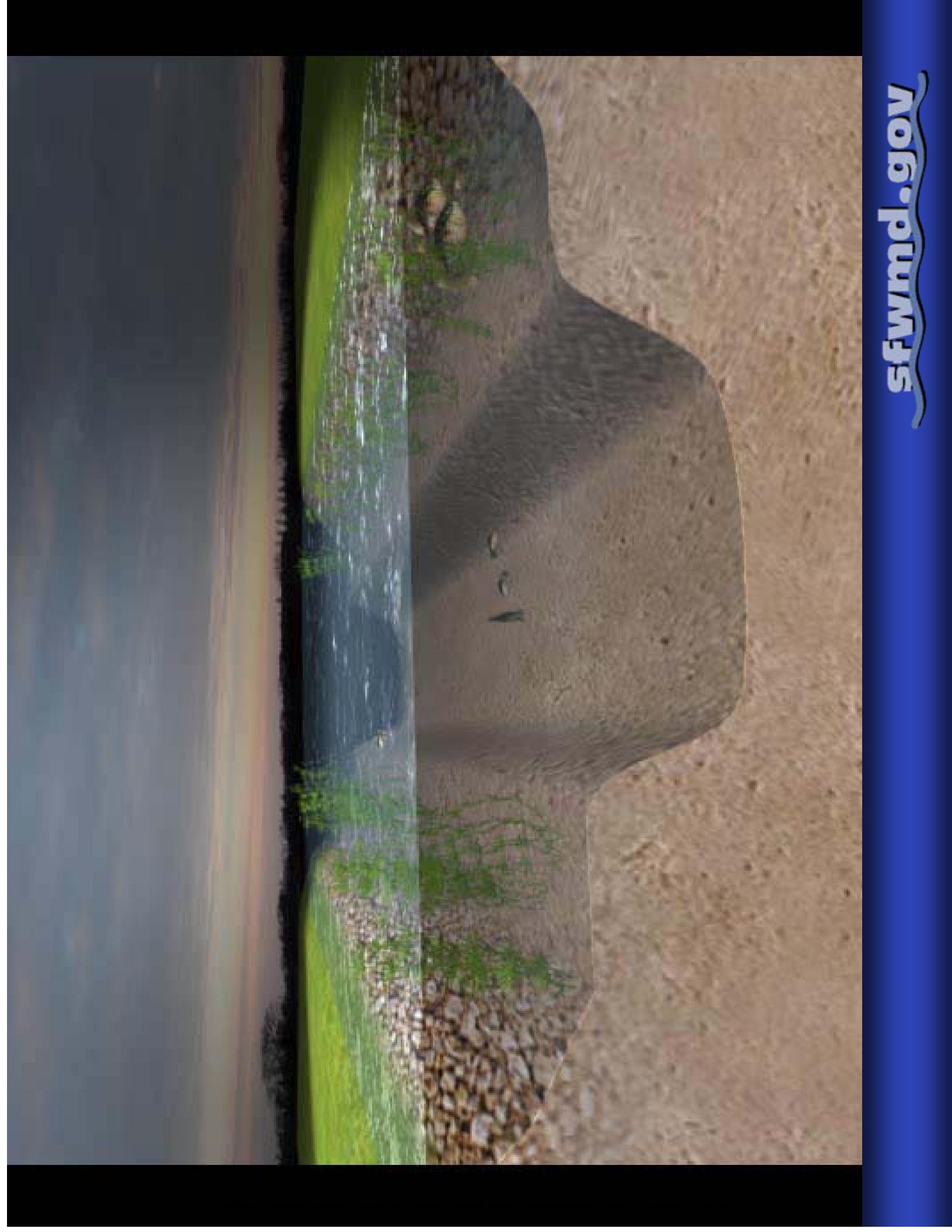


Step 4: Linkages Between Hydrology and Biology

- Defined through use of performance measures linking hydrology to biologic response
- Best available data
- Restoration demonstration project studies
 - Interim responses to Phase I of the restoration project
- Analysis of pre-channelization stage and flow data
- Literature review



sfwmd.gov

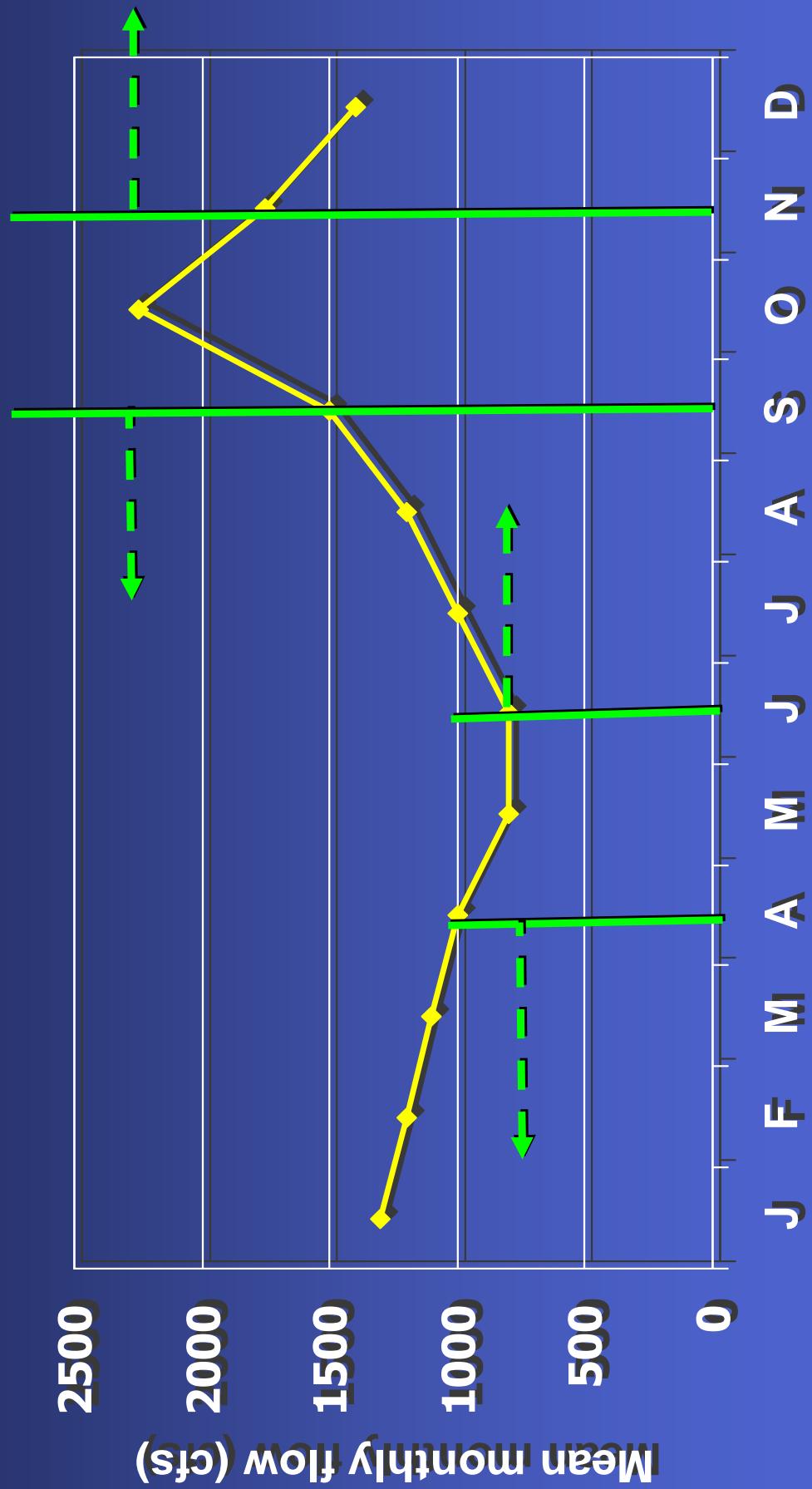


sfwmd.gov

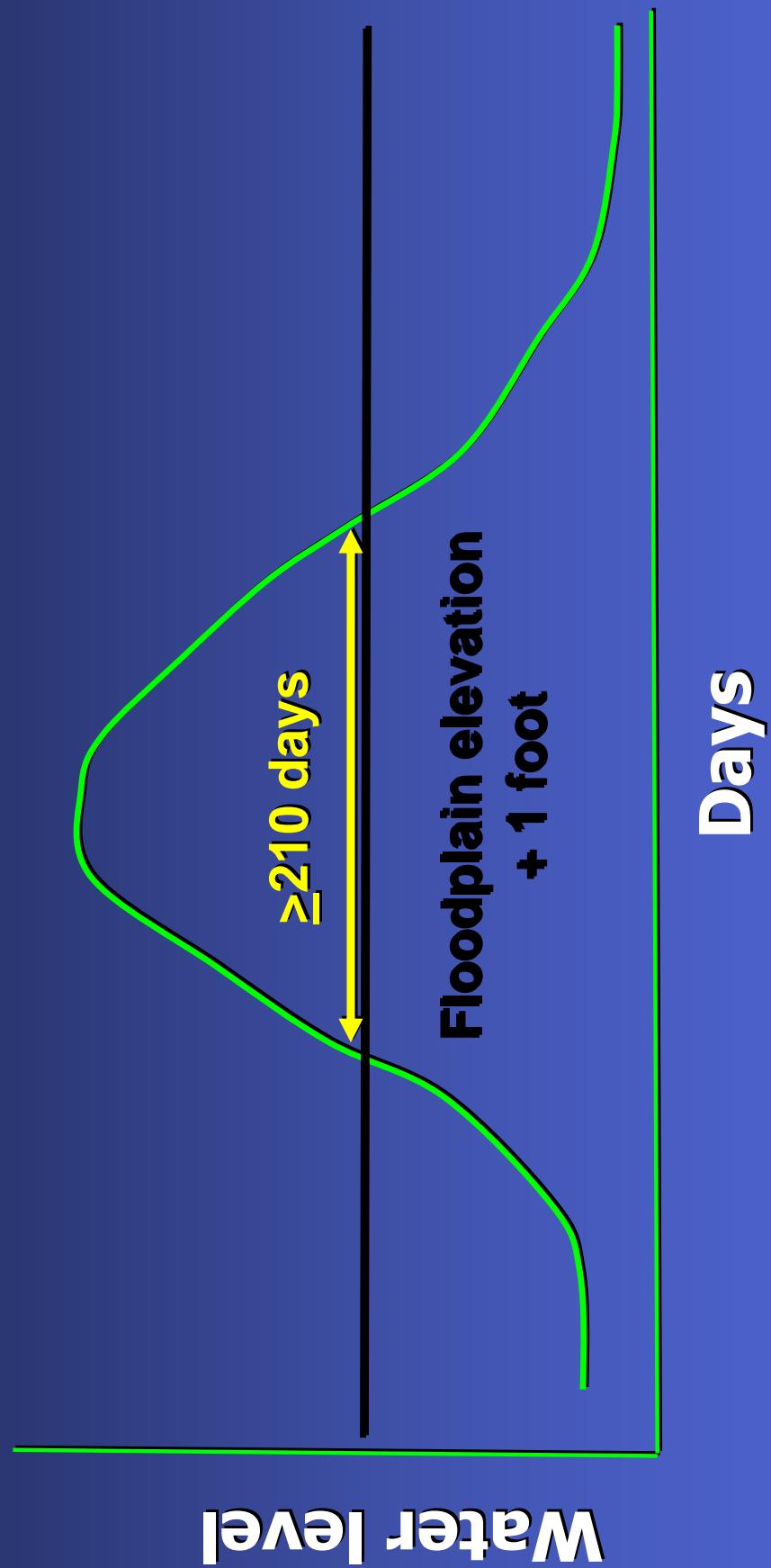
Performance Measures Used to Describe Fish and Wildlife Hydrologic Requirements

- R-01 Kissimmee River Flow
 - Seasonality
- R-02 Stage Hydrograph/Floodplain Hydropattern
 - Hydropattern for Broadleaf Marsh
 - Intra- and Inter-annual variability of water levels
- R-03 Water Level Recession
 - Rate of water level decreases
 - Frequency of large water level reversals

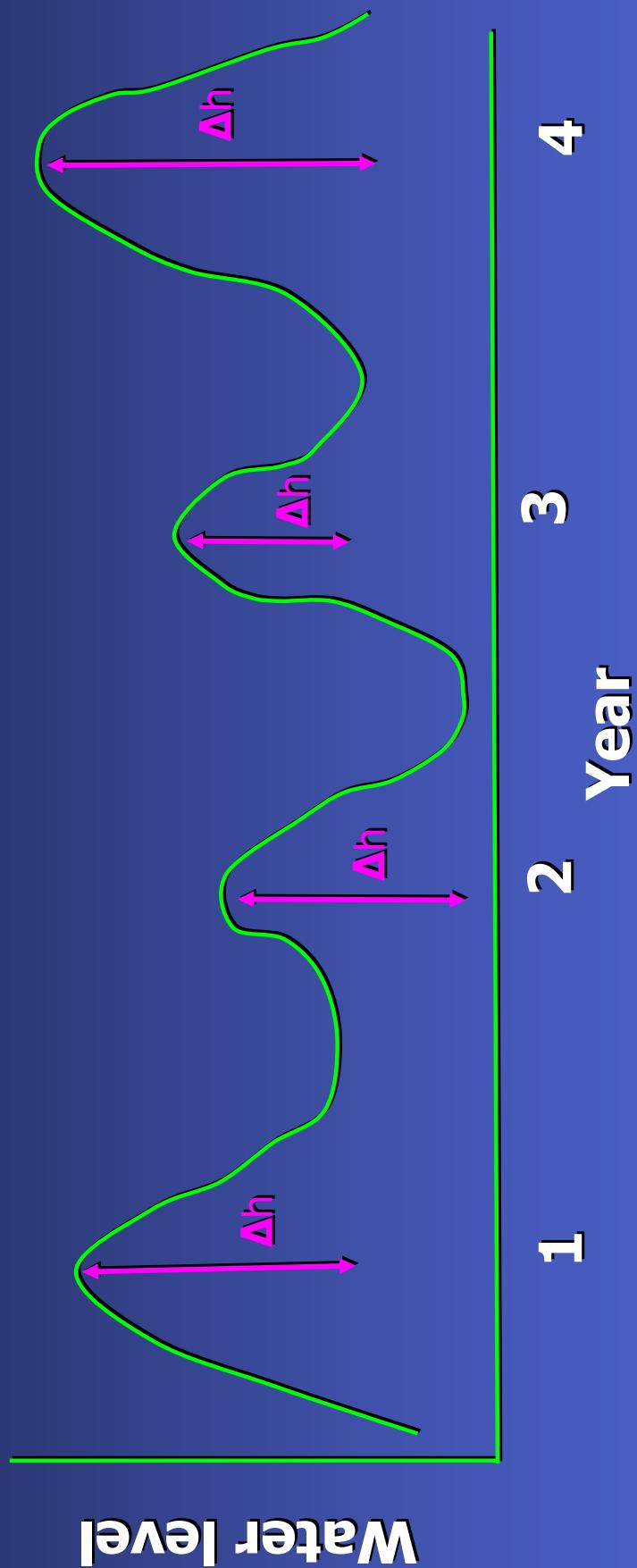
R-01 Seasonality of Flow



R-02 Hydroperiod & Water Level Variability



R-02 Hydroperiod & Water Level Variability



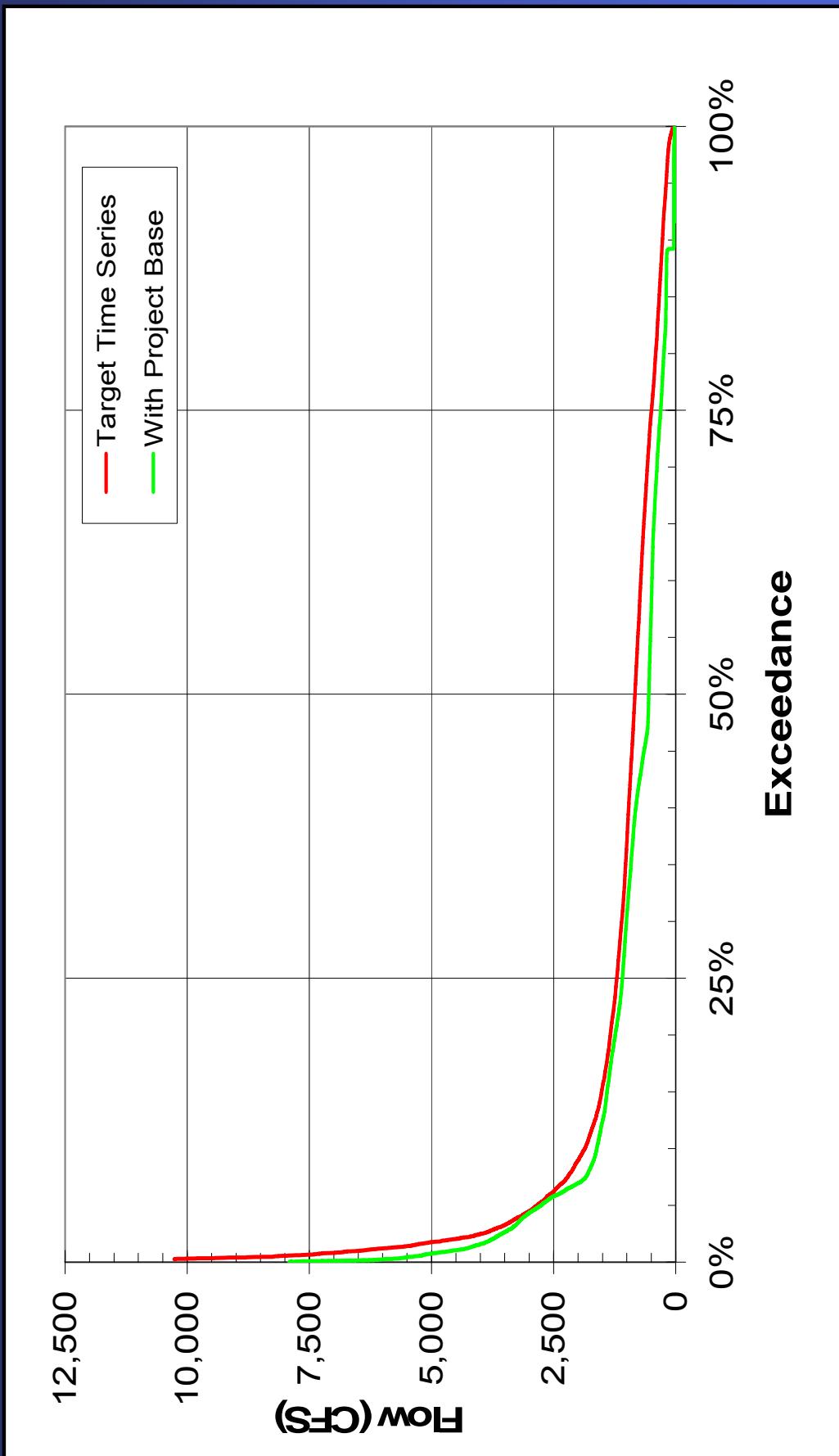
Δh = maximum h - minimum h for a calendar year
Intra-annual variability = average of Δh
Inter-annual variability = standard deviation of Δh

R-03 Water Level Recession



Recession rate = $\Delta h / \Delta t \times 30 \text{ days}$

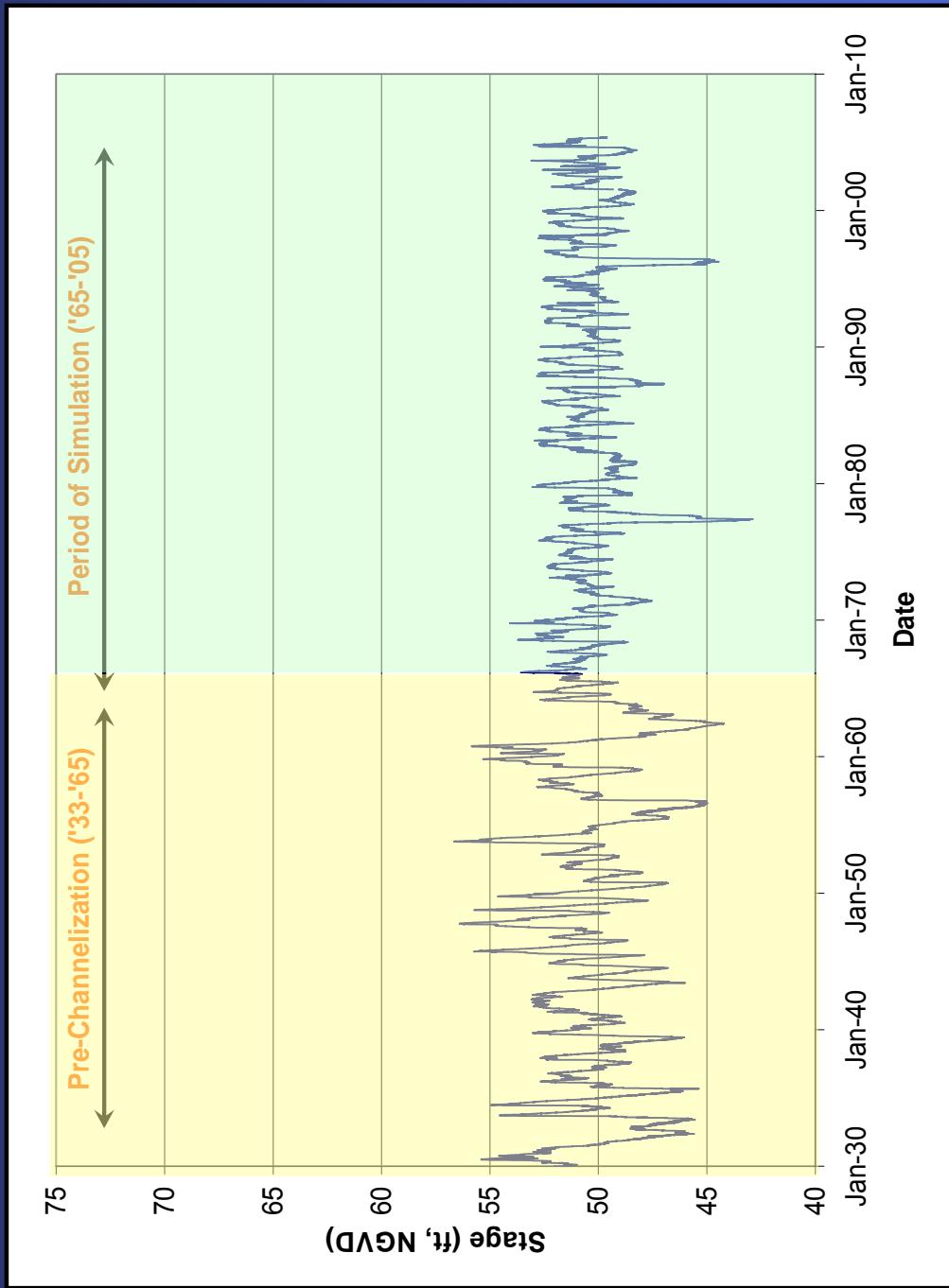
Step 5: Comparison of Kissimmee River Target Time Series And With Project Base Inflows at S-65



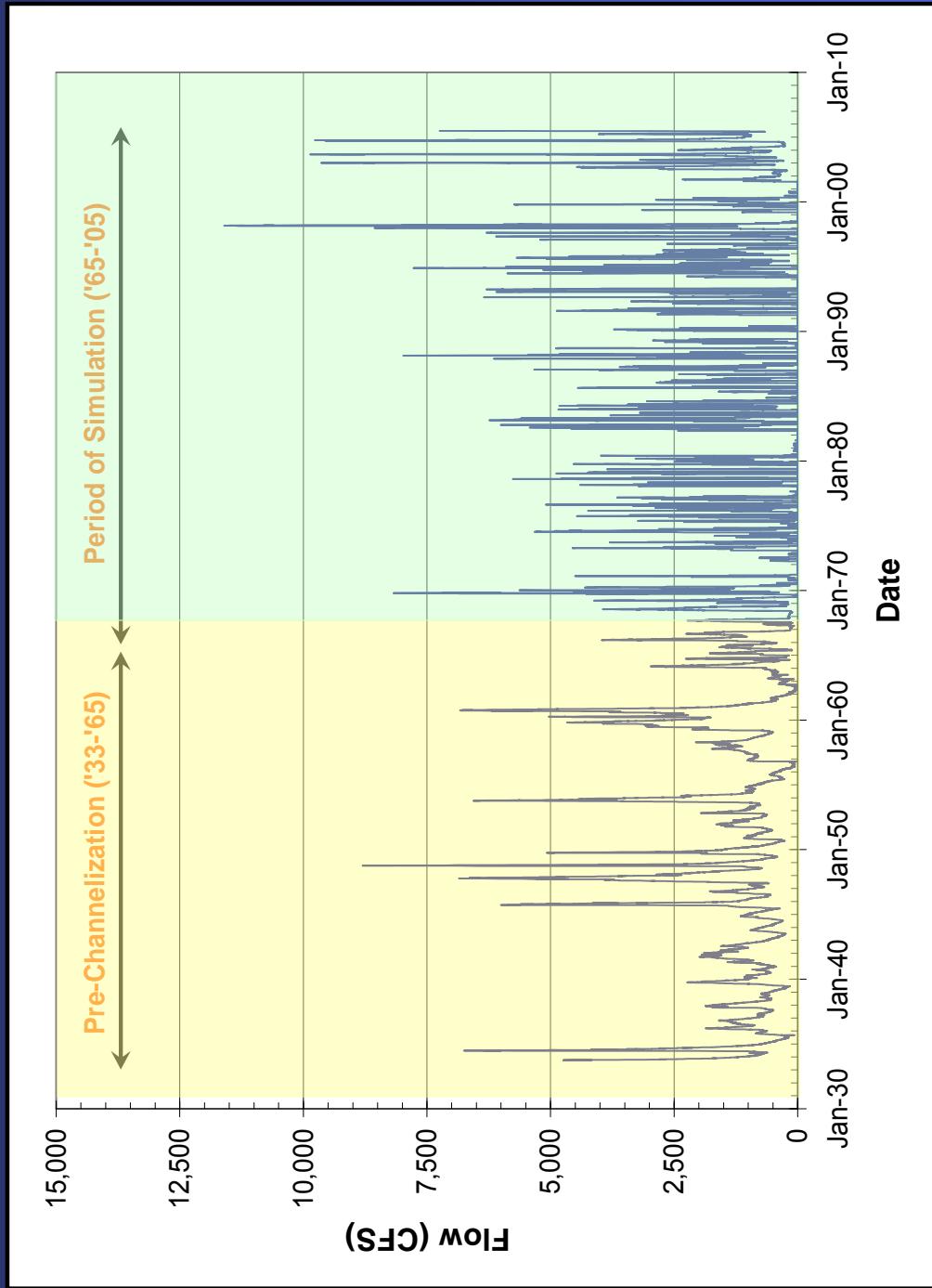
Understanding Where the Water Went

- The preliminary results show that the With Project Base Condition does not have sufficient water to meet the needs of fish and wildlife in the restored Kissimmee River and Floodplain
- What has changed from the pre-channelization conditions?
- The results can be influenced by:
 - The modeling tools
 - Hydrology and hydraulics in the Kissimmee Basin
 - Climate

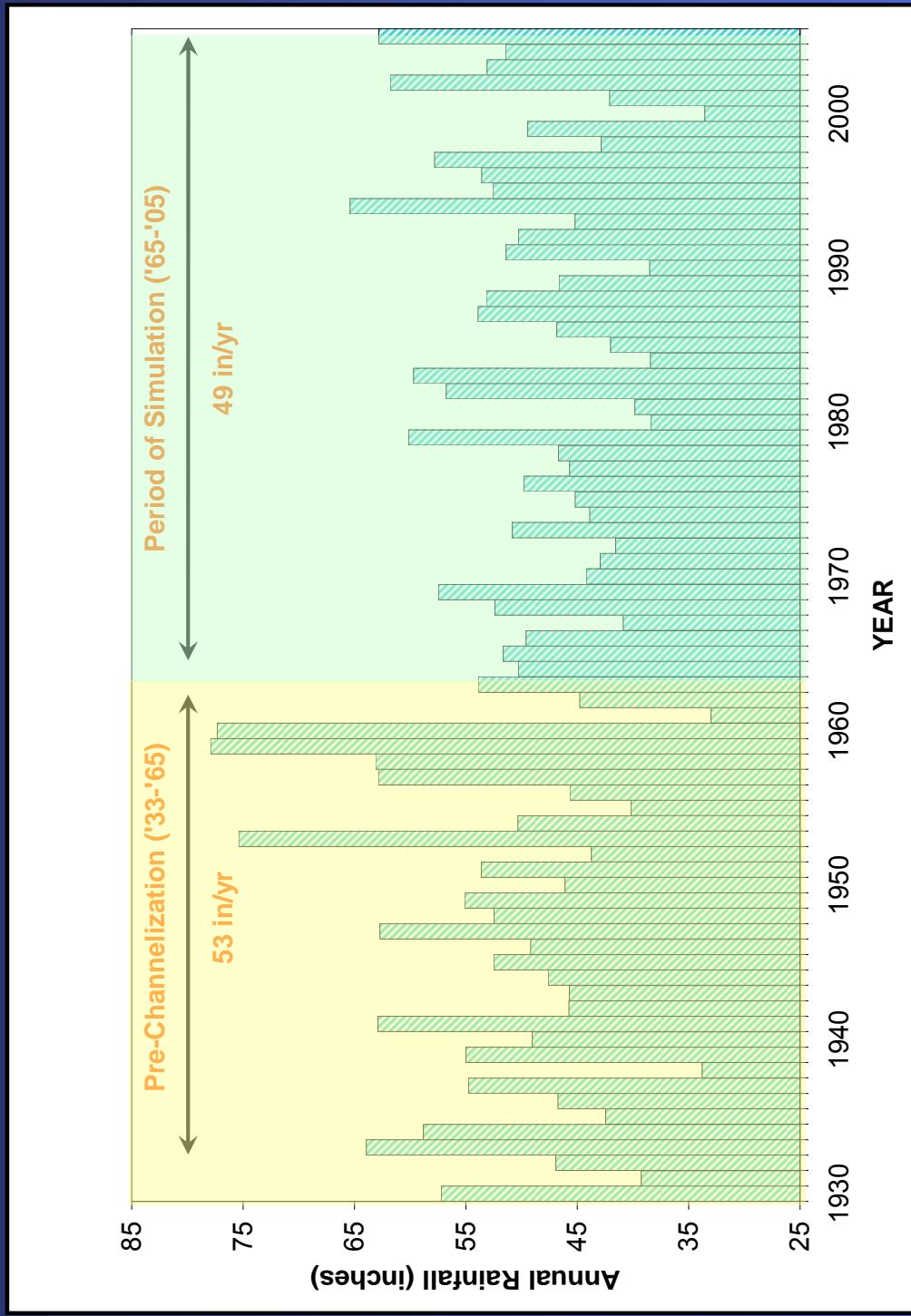
Historic Stage in Lake Kissimmee



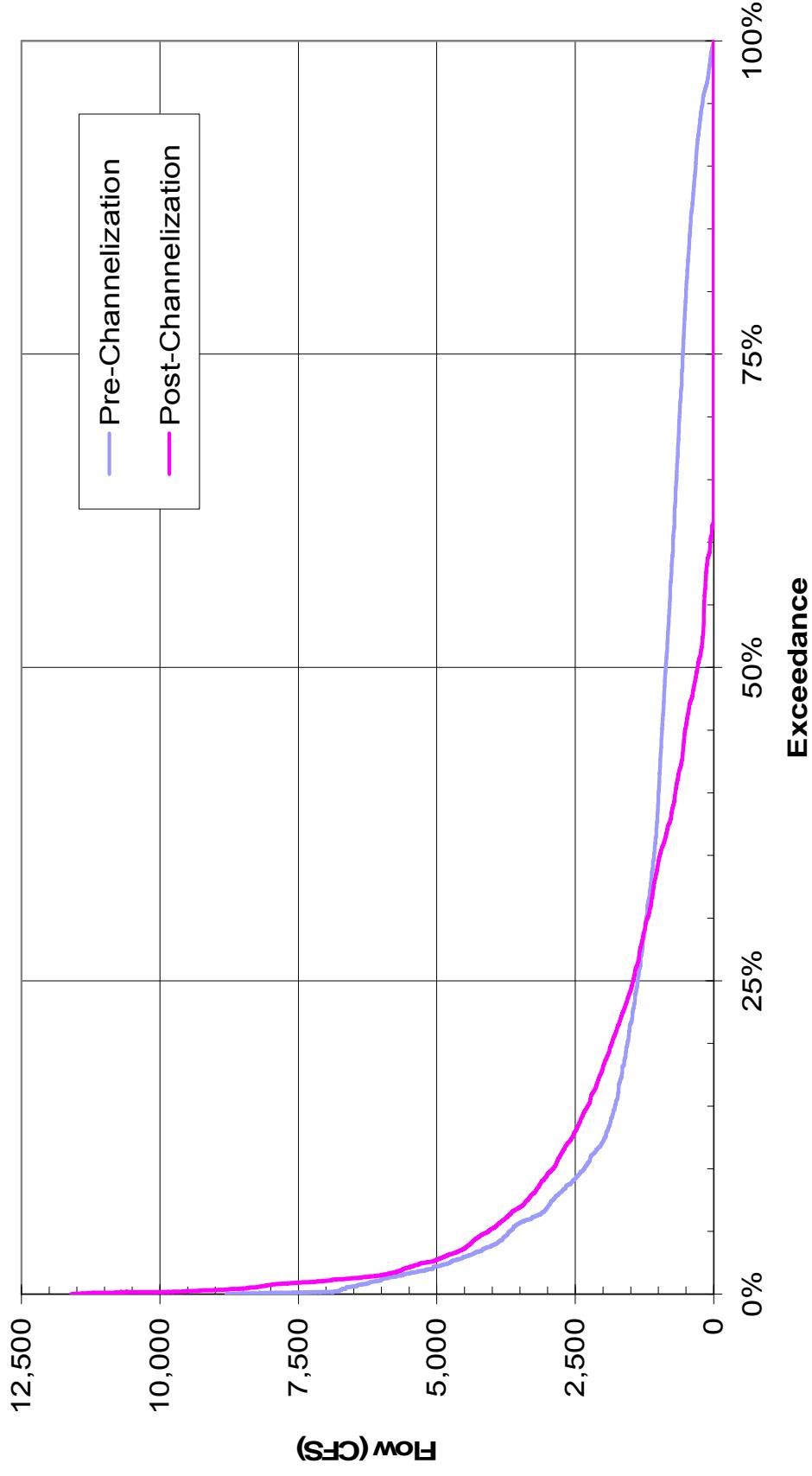
Historic Flow From Lake Kissimmee into the Kissimmee River



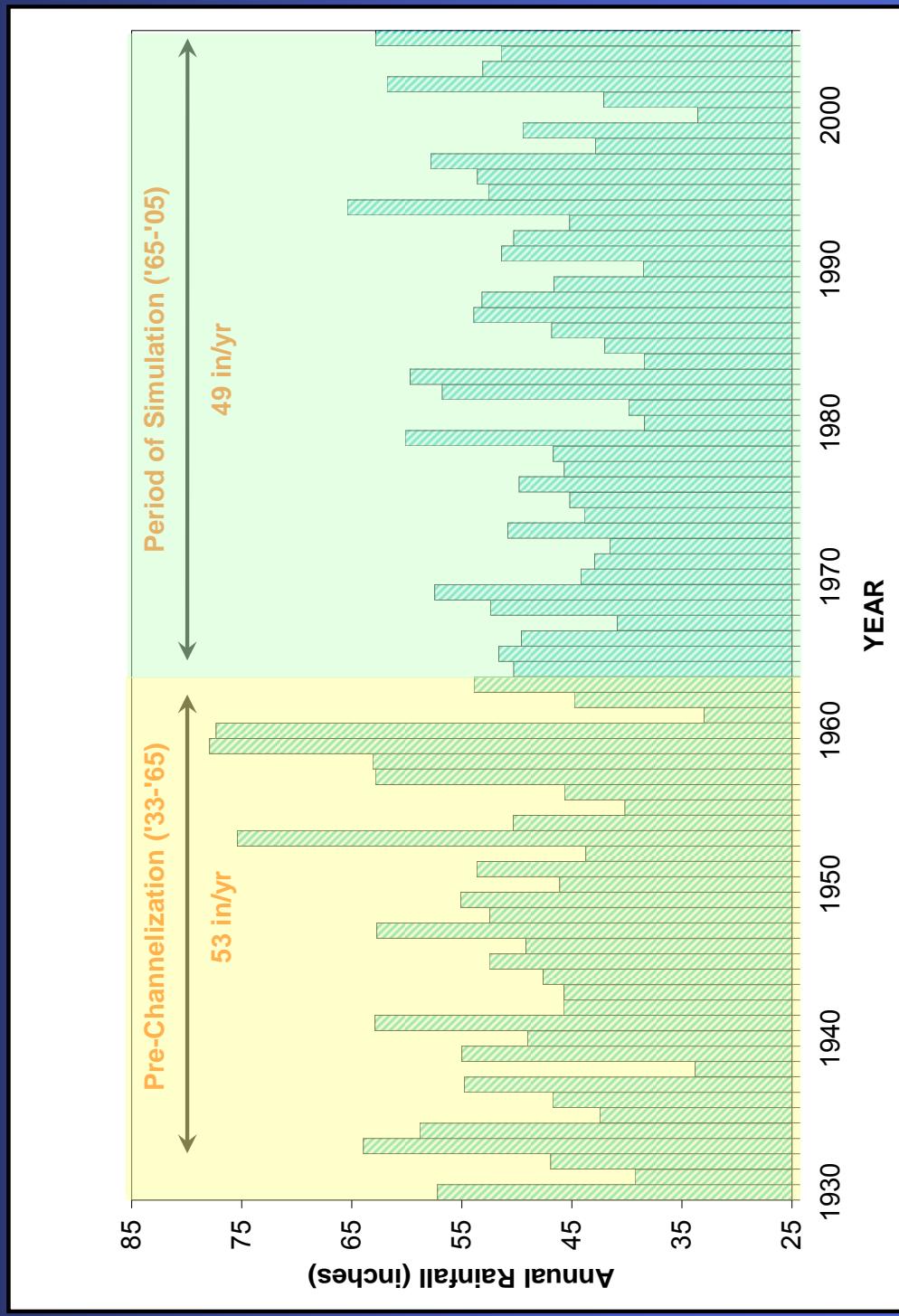
Pre- and Post-Channelization Rainfall



Comparing the Pre- and Post-Channelization Flows at S-65



Pre- and Post-Channelization Rainfall



Hydrologic Comparison of Observed Rainfall and Flows

Timeframe	Years	Average Annual Discharge		Average Rainfall
		CFS	kAF	
Period of Analysis	'33 - '05	1,070	775	51
Pre-Channelization	'33 - '64	1,185	860	53
W/Project Base	'65 - '05	980	710	49
Target Time Series*	'65 - '05	1,076	780	

* - Hypothetical Time Series

Hydrologic Comparison of Observed Rainfall and Flows

Timeframe	Years	Average Annual Discharge		Average Rainfall
		CFS	kAF	
Period of Analysis	'33 - '05	1,070	775	51
Pre-Channelization	'33 - '64	1,185	860	53
W/Project Base	'65 - '05	980	710	49
Target Time Series*	'65 - '05	1,076	780	

* - Hypothetical Time Series

Hydrologic Comparison of Observed Rainfall and Flows

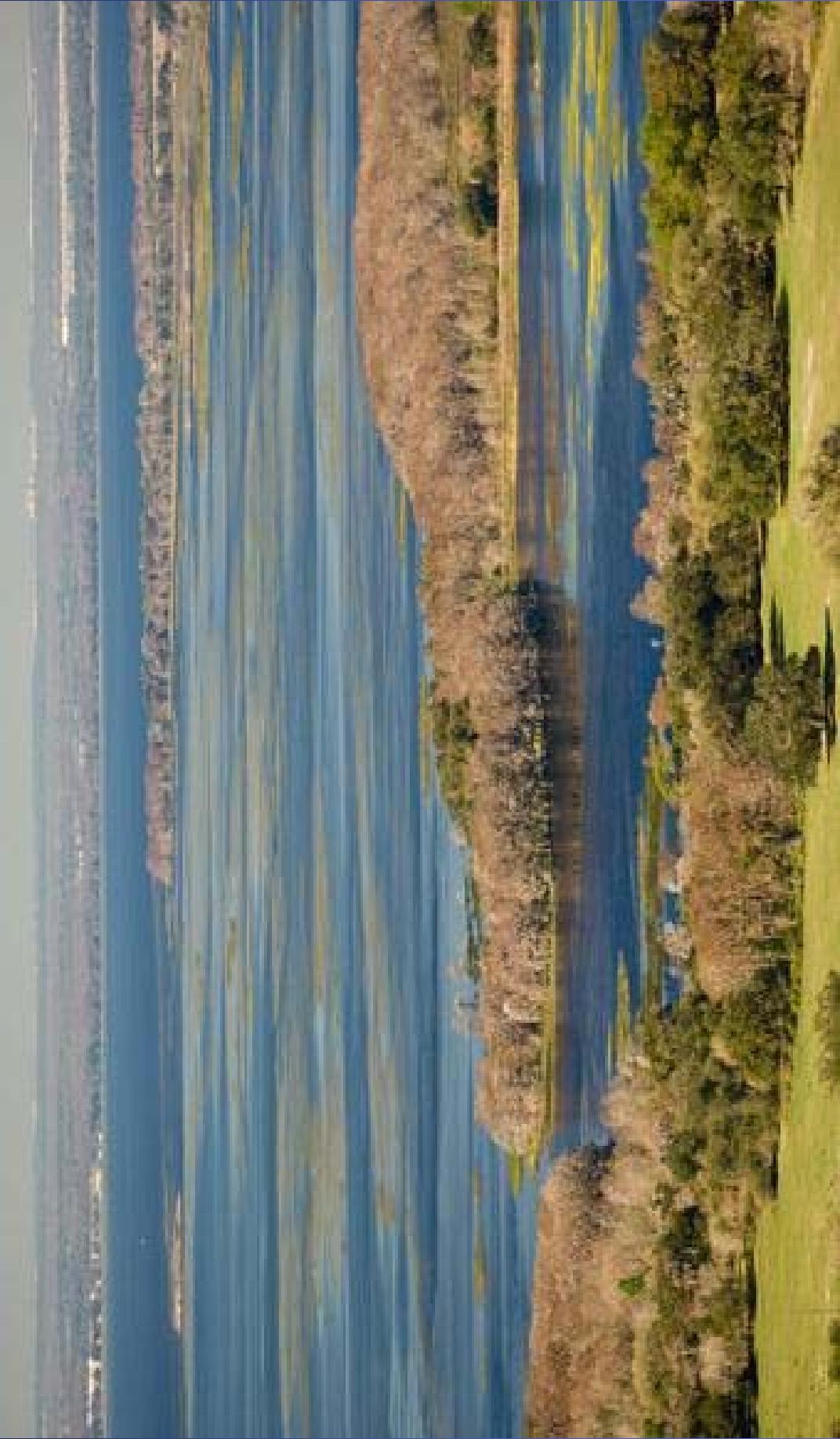
Timeframe Years	Average Annual Discharge		Average Rainfall
	CFS	kAF	
Period of Analysis '33 – '05	1,070	775	51
Pre-Channelization '33 – '64	1,185	860	53
w/Project Base '65 – '05	980	710	49
Target Time Series* '65 – '05	1,076	780	

* - Hypothetical Time Series

River Conclusions

- The water required for the protection of fish and wildlife:
 - Is based on a set of River Performance Measures that are consistent with the Kissimmee River Restoration Project.
 - Has been developed using modeling tools that have been calibrated, verified and undergone Peer Review
 - The quantity of water required for the protection of fish & wildlife is consistent and within the range of observed flows over the past 70 years
 - Based on the preliminary results, all water in river (inflows at S-65 and outflows at S-65E) is required for the protection of fish and wildlife.

Kissimmee Chain of Lakes



Key Assumptions: Kissimmee Chain of Lakes



- Fish and wildlife to be protected are based on what's there now
- What's there now is a function of historic occurrence of water
- Performance measures used for reservation tied to existing regulation schedule

Key Assumptions: Kissimmee Chain of Lakes (cont.)

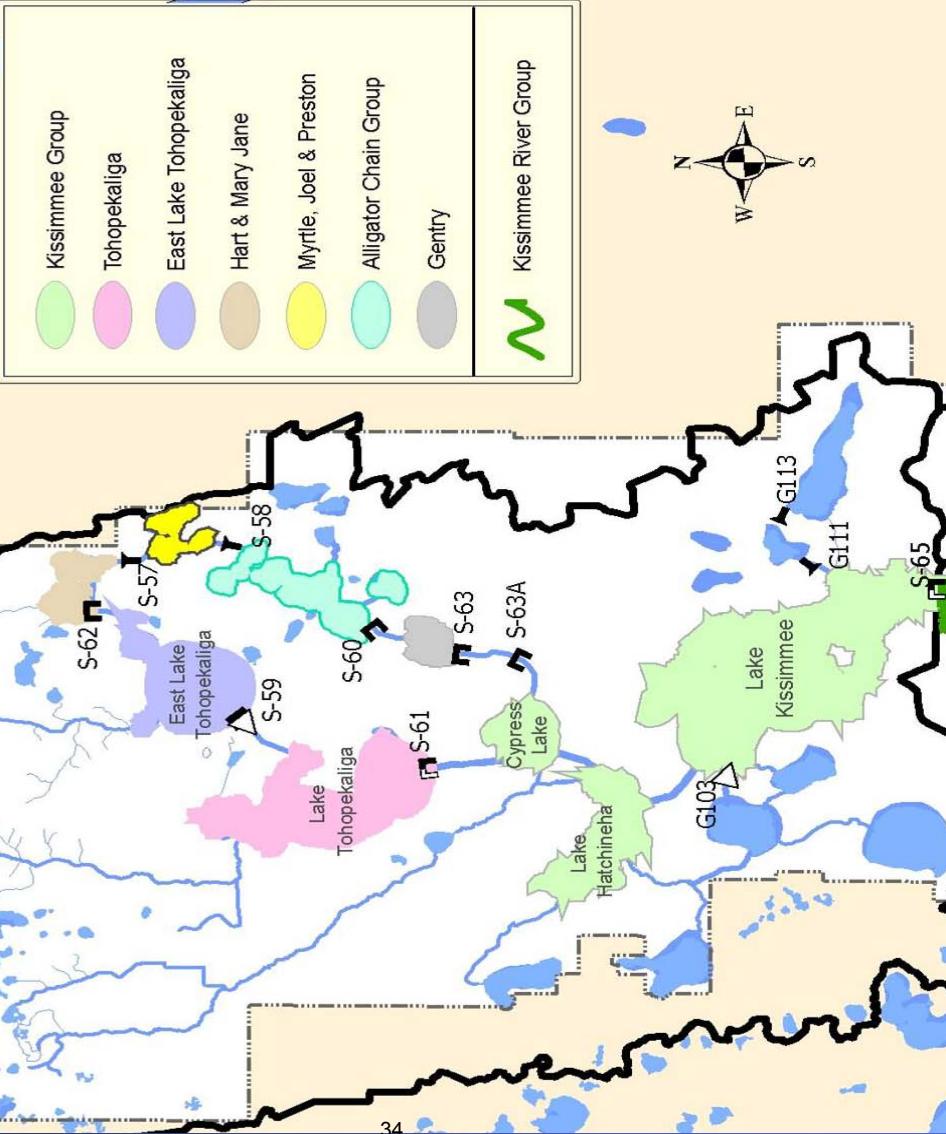


- Revisions to the existing USACE regulation schedule underway
- 1 to 3 years for USACE to complete revised regulation schedule
- Outcome of revision uncertain now

Key Assumptions: Chain of Lakes (cont.)

- Governing Board seeks to protect water for fish and wildlife now, does not want to delay reservations until the Corp establishes a new regulation schedule.
- District will revisit reservation when new regulation schedule is implemented and change reservation rule as necessary.

Step 1: Reservation Waterbodies: Kissimmee Upper Basin (KUB)



Step 2: Fish & Wildlife of the Kissimmee Chain of Lakes

- **Fish - 45 species total, 26 species common, includes gamefish**
- **Wading and other Water Birds - 10 species of wading birds, 3 important rookeries, waterfowl**
- **Threatened and Endangered Species – snail kites, wood storks, sandhill cranes, bald eagles**
- **Amphibians and Reptiles - 14 species of amphibians, 19 species of reptiles including the American Alligator**
- **Mammals – 4 species river otter, marsh rabbit, marsh rice rat, and round-tailed muskrat**

Distribution of Major Fish and Wildlife Resources Among Lakes

Fish	Rookery	Snail Kites	Sandhill Cranes	Alligator
Kissimmee	X	X	X	X
Toho	X	X	X	X
East Toho	X	X	X	X
Hart & MJ	X	X	X	X
Alligator Chain	X			X
Gentry	X			0
Myrtle	0			0

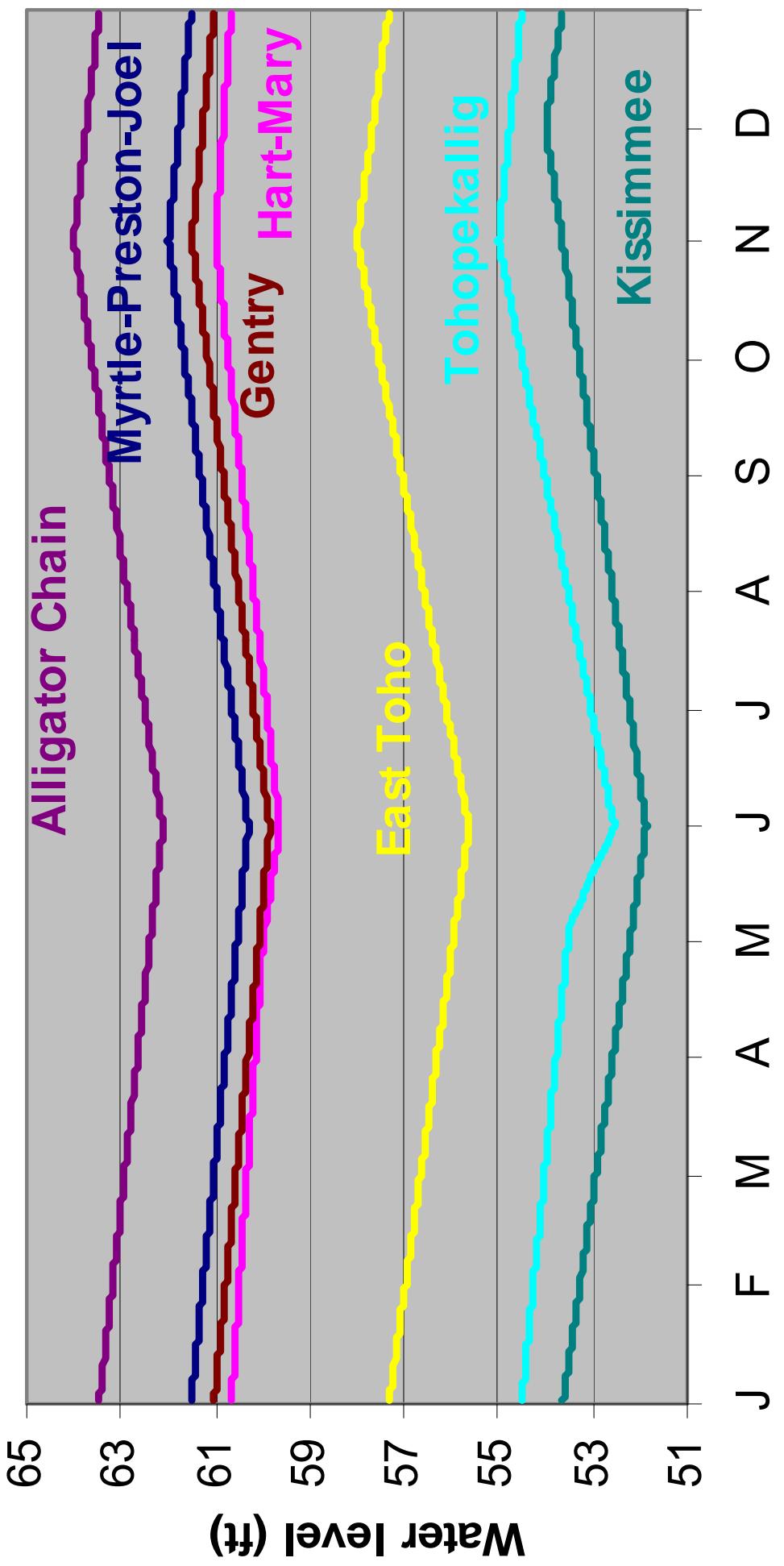


Linkages Between Hydrology and Biology

- One performance measure for each reservation water body
- The performance measure is represented as an annual hydrograph
- Hydrograph represents the threshold for lake water levels below which is needed to protect fish & wildlife and above which is in excess of the water needed to protect fish & wildlife

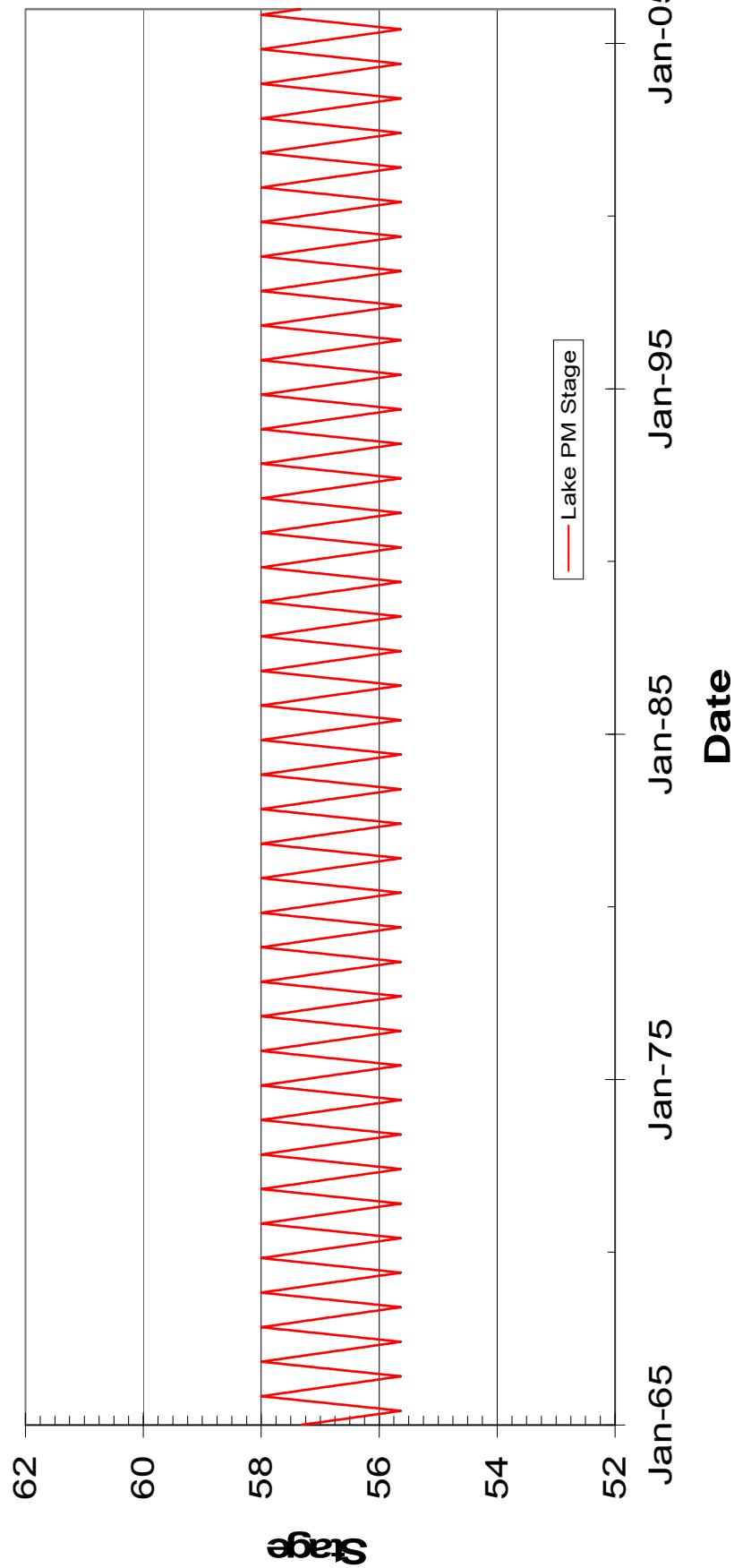


7 Performance Measure Hydrographs



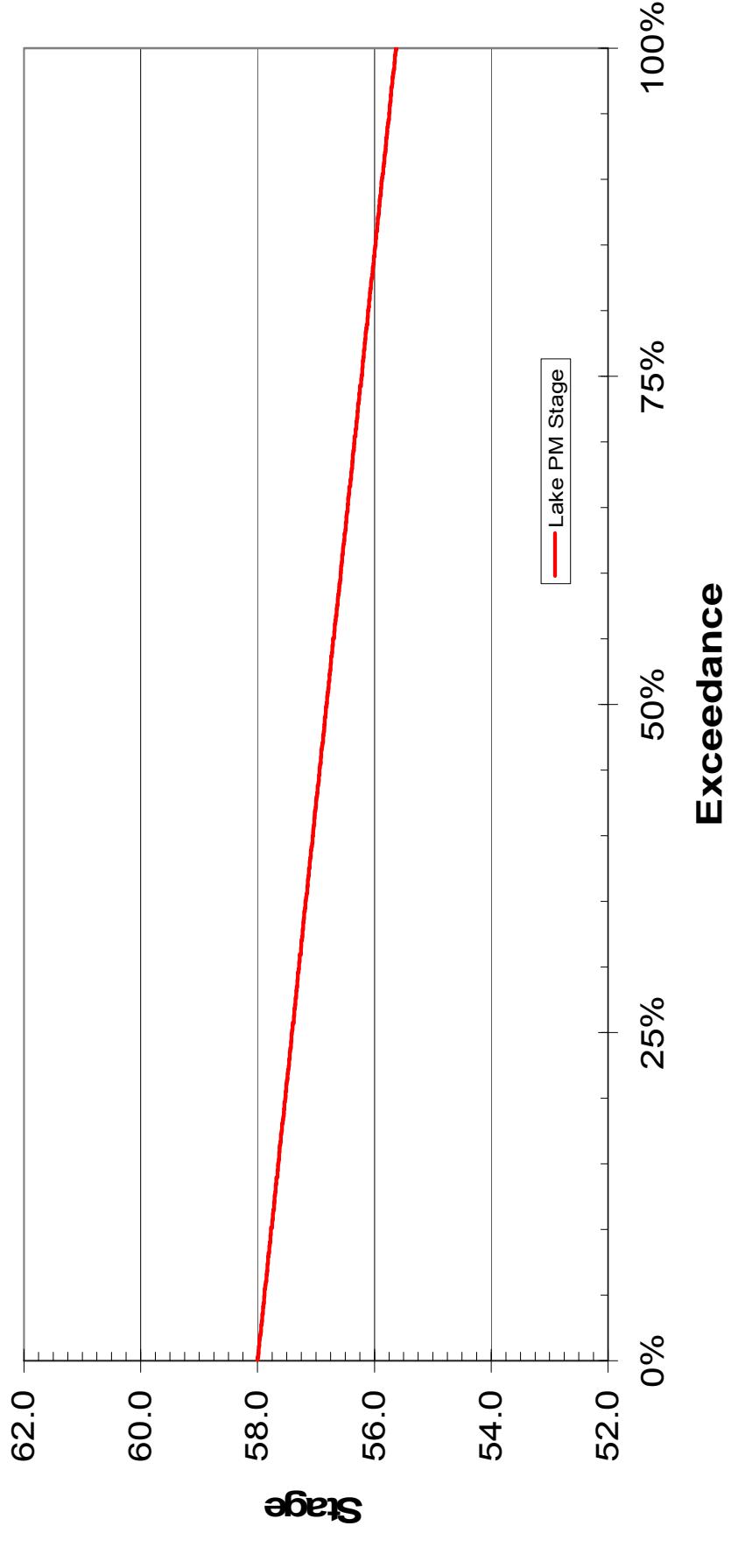
Lake Performance Measures Threshold Stage Hydrograph

East Lake Toho (S-59)
Lake Performance Measure Stage Hydrograph



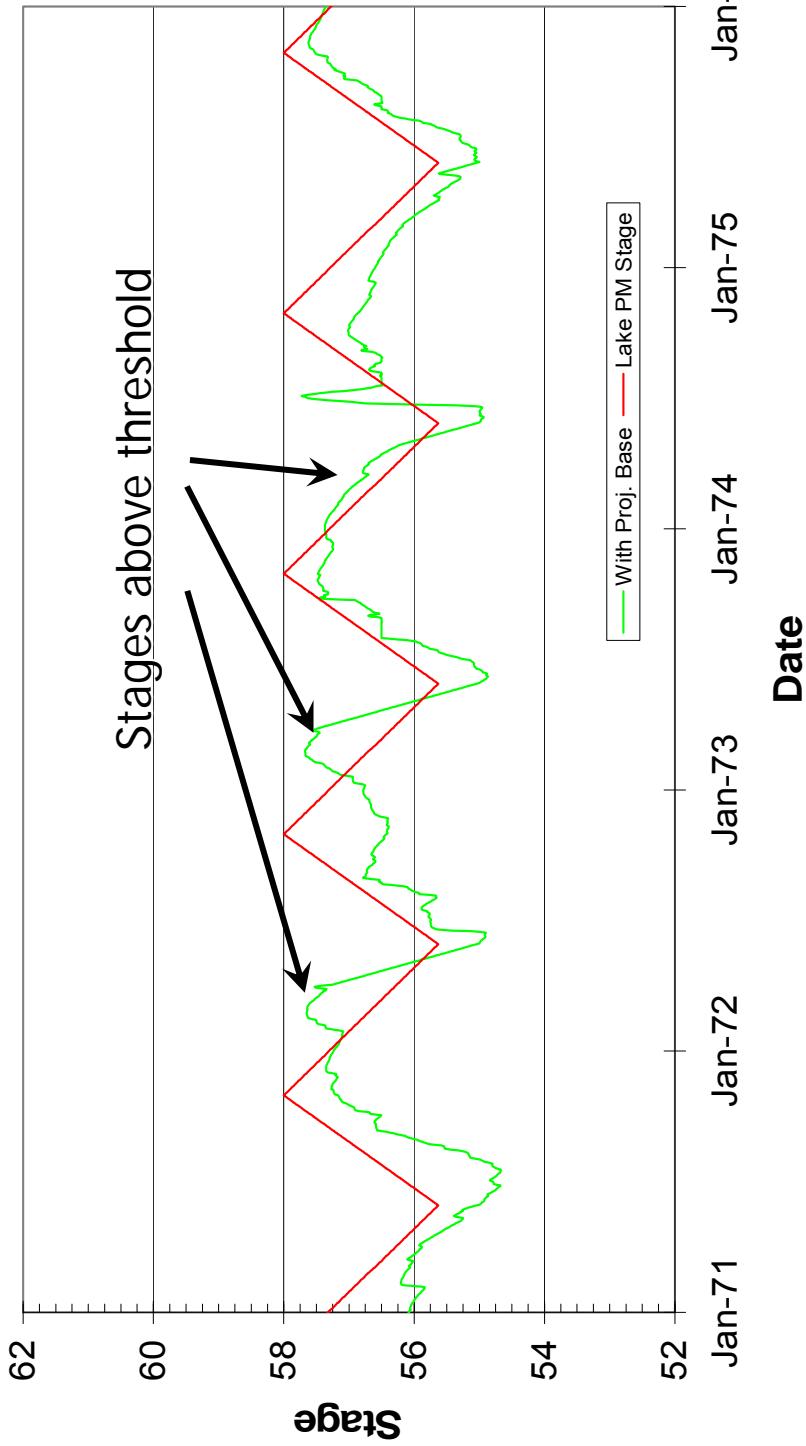
Lake Performance Measures Threshold Stage Probability

East Lake Toho (S-59)
Lake Performance Measure Stage Exceedance



Lake Performance Measures Threshold Stage Hydrographs

East Lake Toho (S-59)
Comparison of Lake PM Stages and With Project Base



Comparison of With Project Base with Target Stage Data

East Lake Toho (S-59) CDF Data
Comparison of Lake PM Stages and With Project Base



Conclusions: Lakes

- The Lake Performance Measure Stage represents a threshold under which water is required for the protection of fish & wildlife
- Comparison of stages from the “With Project Base” condition identify periods of potential surplus water under very wet conditions
- Exceptions: Kissimmee Cypress Hatchineha and Myrtle Preston Joel
- Ongoing efforts will further evaluate the water necessary for the protection of fish and wildlife within the seven lake reservation water bodies

What's Next

- Complete ongoing evaluations to define reservations
 - Re-evaluate Kissimmee, Hatchineha, Cypress lake performance measures and re-evaluate water for protection of F&W for the water body
- Complete generation of lower bounds of range of acceptability evaluation
 - Calculate range of acceptable flows between KCOL that are protective of fish and wildlife

What's Next (cont.)

- Evaluate stakeholder alternatives/comments
- Quantify waters above the line defining waters needed for protection of fish and wildlife
- Define the recommended water reservations
 - Discuss results and staff recommendations with stakeholders at March 26th workshop
- Scientific peer review March 31st
- Seek Governing Board direction on recommended reservations at the April 8th meeting
- Rule drafting



Challenges

- Integrated evaluation of fish and wildlife needs for both Chain of Lakes and restored River is new
- Existing regulation schedules don't balance water needs for fish and wildlife north and south of S-65
- As a result, preliminary analysis indicates:
 - Deficiencies in the volume and timing of water needed for protection of fish and wildlife in the restored River
 - Existing regulation and structural constraints produce some surplus water conditions in some of the KCOL during extreme wet conditions

Challenges (cont.)

- How to reserve water needed for the protection of fish and wildlife when there is a range of possible solutions?
- What factors result in a range of possible solutions:
 - Model accuracy
 - Robustness of biologic response to variation of water
- Goal is to define a set of bounds within which decision makers are equally sure/unsure that the desired response will occur
- Describe how today, results at next workshop

Challenges (cont.)

- The USACE's revised regulation schedule will evaluate operational fixes to more effectively distribute water
- Opportunity exists to evaluate structural constraints of system for flood protection and environmental enhancement in future
- Policy question: How to protect water for fish and wildlife today knowing there may be future opportunities to redirect surpluses to meet deficits downstream

Questions

